FORM PTO-1390 (REV 11-2000)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		1807-0159P
		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 10/068240

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/SE00/01623	August 24, 2000	August 24, 1999

TITLE OF INVENTION
METHOD AND ARRANGEMENT FOR REGISTERING AND VERIFYING FINGERPRINT INFORMATION

APPLICANT(S) FOR DO/EO/US
KRUSE, Bjorn

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39 (1).
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
    a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau). WO 01/15066
    b. ☒ has been transmitted by the International Bureau.
    c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
    a. ☐ is transmitted herewith.
    b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4)
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
    a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
    b. ☐ have been transmitted by the International Bureau.
    c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
    d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 20. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98, Form PTO-1449(s), and International Search Report (PCT/ISA/210) with 0 cited document(s).
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821-1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information:
    1.) PCT/IPEA/409
    2.) PCT/IB/304
    3.) Two (2) sheets of Formal Drawings

U.S. APPLICATION NO (if known, see 37 CFR 1 5) **10/069240**	INTERNATIONAL APPLICATION NO PCT/SE00/01623	ATTORNEY'S DOCKET NUMBER 1807-0159P

21. ☒ The following fees are submitted·		CALCULATIONS	PTO USE ONLY

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5):

Neither international preliminary examination fee (37 CFR 1.482)
nor international search fee (37 CFR 1.445(a)(2)) paid to USTO
and ·International Search Report not prepared by the EPO or JPO. $1,040.00

International preliminary examination fee (37 CFR 1.482) not paid to
USPTO but International Search Report prepared by the EPO or JPO $890.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO
but international search fee (37 CFR 1.445(a)(2)) paid to USPTO. $740.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO
but all claims did not satisfy provisions of PCT Article 33(1)-(4) $710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO
and all claims satisfied provisions of PCT Article 33(1)-(4). $100.00

	ENTER APPROPRIATE BASIC FEE AMOUNT =	$	1040.00	

Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		$	0	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	16 - 20 =	0	X $18.00	$	0
Independent Claims	3 - 3 =	0	X $84.00	$	0
MULTIPLE DEPENDENT CLAIM(S) (if applicable)		Yes	+ $280.00	$	280.00
		TOTAL OF ABOVE CALCULATIONS =		$	1320.00
☒ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				$	-660.00
			SUBTOTAL =	$	660.00
Processing fee of **$130.00** for furnishing the English translation later than ☐20 ☐30 months from the earliest claimed priority date (37 CFR 1.492(f)).			+	$	0
		TOTAL NATIONAL FEE =		$	660.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property			+	$	40.00
		TOTAL FEES ENCLOSED =		$	700.00
				Amount to be: refunded	$
				charged	$

a. ☒ A check in the amount of $ <u>700.00</u> to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account. No. _____ in the amount of $_____ to cover the above fees.
    A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>02-2448</u>.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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Date: <u>February 22, 2002</u>

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/cqc

PATENT
1807-0159P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: KRUSE, Bjorn

Int'l. Appl. No.:   PCT/SE00/01623

Appl. No.:   New   Group:

Filed: February 22, 2002   Examiner:

For: METHOD AND ARRANGEMENT FOR REGISTERING AND VERIFYING FINGERPRINT INFORMATION

PRELIMINARY AMENDMENT

BOX PATENT APPLICATION
Assistant Commissioner for Patents   February 22, 2002
Washington, DC 20231

Sir:

The following Preliminary Amendments and Remarks are respectfully submitted in connection with the above-identified application.

AMENDMENTS

IN THE SPECIFICATION:

Please amend the specification as follows:

Before line 1, insert --This application is the national phase under 35 U.S.C. § 371 of PCT International Application No. PCT/SE00/01623 which has an International filing date of February 24, 2000, which designated the United States of America.--

Docket No. 1807-0159P

REMARKS

The specification has been amended to provide a cross-reference to the previously filed International Application.

Entry of the above amendments is earnestly solicited. An early and favorable first action on the merits is earnestly solicited.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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1807-0159P

(Rev. 11/13/01)

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TITLE
Method and arrangement for registering and verifying fingerprint information

TECHNICAL FIELD
5   The present application relates to a method and an arrangement for registering and verifying fingerprint information.

BACKGROUND ART
There are a great many fields within which it is necessary to verify the identity
10   of a person, in other words to answer the question of whether a certain person is who he claims to be and is thus authorized to use a certain type of equipment. Examples of such equipment are automatic cash dispensers, access systems and various types of electronic equipment, for example mobile telephones and computers.
15
A conventional manner of carrying out verification is for the user to have a code or a password which he has to input in a verification procedure. If the code is correct, the user is considered to be authorized to use the equipment. However, it can be difficult for a user to remember a large number of different
20   codes and passwords, for which reason alternative ways of verifying the authority and/or identity of a user are necessary. One such alternative method is to have a user register information relating to one or more of his fingerprints in a verification unit, the user then, in a verification procedure, placing the finger or fingers whose print is registered against a surface on the
25   verification unit. The unit analyses whether the fingerprint corresponds to the necessary degree to the fingerprint whose information is stored and, if so, the fingerprint is considered verified, and the user is permitted to use the equipment in question.

30   Identification by means of fingerprints has traditionally been used mostly within the field of crime prevention, where the question to be answered is not whether a fingerprint corresponds to another to the necessary degree. In that field, an attempt is instead made to establish a match with a specific fingerprint in an extensive register of fingerprints. This type of use of
35   fingerprints does not involve the same great requirement for speed as a

verification procedure of the type described above. Speed is also highly desirable in the registering of fingerprint information for use in verification.

5   Another important parameter, for both registering and verification of fingerprint information, is reliability.

DISCLOSURE OF INVENTION
The problem solved by the present invention is therefore that of providing an arrangement and a method affording rapid and reliable registering of
10   fingerprint information, and of providing a corresponding arrangement and method for rapid and reliable verification of a fingerprint on the basis of previously registered fingerprint information.

This problem is solved by means of a method for registering fingerprint
15   information via a sensing surface A, in which a finger can be held against or over at least a part of the sensing surface A, which method comprises scanning part surfaces in the sensing surface A. During scanning of the part surfaces, it is checked whether the centre point, with its immediate surrounding area, of each scanned part surface is unique within the part
20   surface.

A number of centre points which, with their respective immediate surrounding areas, are unique in their respective part surfaces are registered, the respective immediate surrounding areas of the points and the respective part
25   surfaces of the points also being registered.

A certain number of the registered centre points with their immediate surrounding areas are suitably selected for further use, for example for verifying fingerprints.
30
The abovementioned problem is also solved by means of a method for verifying fingerprint information via a sensing surface A, against or over at least a part of which sensing surface A a finger can be held, in which verification is carried out on the basis of previously registered information
35   relating to at least one fingerprint which is to be approved in the verification

method, and in which information has preferably been registered according to the registering method described above.

The verification method according to the invention comprises a number of part surfaces with their respective centre points in the fingerprint whose information is stored being compared with corresponding part surfaces on the sensing surface A. If there is a point on a part surface on the sensing surface A which, with its immediate surrounding area, corresponds, on the basis of certain criteria, to the stored centre point, including the immediate surrounding area of the stored centre point in the corresponding stored part surface, the point with its part surface is approved. If a certain number of points with associated part surfaces have been approved, these are selected for a first step in further processing.

This first step in further processing suitably comprises a number of the selected points and the part surfaces being analysed as a group, the mean value of the coordinates for the points in their respective part surfaces being calculated. The mean value calculated is seen as a point in each part surface, and a certain number of the points with their associated part surfaces are selected for a second step in further processing, the points which are selected being those points in the group which have the smallest distance to the mean value point in their respective part surface. This is done in order that an arrangement or a method according to the invention will be independent of translation of the print at the time of verification in relation to the position of the finger at the time of registering, translation being defined as right-angled displacements of the finger relative to the position of the finger at the time of registering.

The invention also comprises a method for making it possible to be independent of rotation of the finger at the time of verification in relation to the position of the finger at the time of registering. This method will be described in greater detail below.

The invention also comprises arrangements for use in the methods of the types mentioned above.

BRIEF DESCRIPTION OF DRAWINGS

The invention will be described in greater detail below with reference to the appended drawings, in which

Fig. 1 shows a rough block diagram of an arrangement according to the
5   invention,

Fig. 2 shows a basic diagram of the use according to the invention of a part surface on a sensor,

Fig. 3 shows the principle of a calculation according to the invention, and

Fig. 4 shows how a verification method according to the invention can be
10   made insensitive to rotation.

MODE(S) FOR CARRYING OUT THE INVENTION

Fig. 1 shows a rough block diagram of an arrangement 100 according to the invention. The arrangement 100 comprises a central unit 110, a sensor 120,
15   a power supply unit 130, and connections, shown by arrows, between the units. The central unit 110 suitably comprises control arrangements, a memory and at least one arithmetic logic unit (ALU). The control arrangements and the ALU together preferably consist of an integrated circuit, for example a microprocessor.
20

The power supply unit 130 is not of major interest in terms of the invention and will therefore not be described in greater detail. In brief, it can be stated that the power supply can be effected in a great many ways known to the expert, for example batteries, mains connection or solar cells, and can be
25   integrated in the same housing as the rest of the arrangement 100 or separate.

The sensor 120 has a sensing surface A, against or over at least a part of which sensing surface A a finger can be held during use of the arrangement.
30   The sensor 120 comprises a number of sensor elements for scanning the sensing surface A. The sensor elements are preferably capacitive, but other types of sensor element can also be used according to the invention, for example resistive, optical or heat-sensitive elements. Another type of sensor which could be used in connection with the present invention is a pressure-
35   sensitive sensor.

The number of sensor elements per unit area on the sensing surface A can be selected in a great many ways, depending on, for example, the type of sensor, and the desired speed, reliability and resolution. In a preferred embodiment of the invention, with capacitive sensor elements, roughly 200

5   sensor elements are used per mm^2, which corresponds to 144x144 points per cm^2, which on a length scale can be expressed as 14 elements per millimetre. This number is to be considered as only an example, however, and the number of sensor elements per unit area can be either larger or smaller in other embodiments of the invention. However, the number of

10   sensor elements preferably lies within the range 10-50 elements per millimetre.

As mentioned above, the arrangement 100 is intended to be used for registering fingerprint information and for verifying fingerprint information on

15   the basis of previously registered information relating to at least one fingerprint which is to be approved on verification. The previously registered information used for verifying fingerprints has preferably been registered by means of a method according to the invention.

20   Below, a method of registering fingerprint information according to the invention will be described first, and then a method for verifying fingerprint information according to the invention will be described. These methods are implemented by means of an arrangement according to the invention. Both the description of registering and the description of verification below will be

25   given with reference to Fig. 2. None of the parts in Fig. 2 is provided with an index, but parts which have been provided with an index in the text refer to corresponding unindexed parts in Fig. 2.

In a method for registering fingerprint information according to the invention,

30   the user places the finger whose information is to be registered against or over a part of the sensing surface A (shown in Fig. 2) on the sensor 120. The central unit 110 then initiates scanning of the sensing surface A of the sensor 120, which is carried out by part surfaces A'_1 on the sensing surface A being scanned. The part surfaces A'_1 preferably overlap one another in a

35   predetermined manner. The part surfaces A'_1 are suitably all of the same size, which can of course be varied in a great many different ways. However,

a suitable range for the size of the part surfaces A'_1 is 5-50% of the total sensor surface A, 10% of the total sensor surface having been found to be advantageous.

5 During scanning of the part surfaces A'_1, it is investigated, preferably in the central unit 110, whether the centre point P_1 of the part surface, with its immediate surrounding area A''_1, is unique within the part surface A'_1. If so, the point P_1 is approved and is registered together with its immediate surrounding area in the memory of the arrangement 100. The part surface A'_1

10 to which the centre point belongs is also registered.

Scanning of the sensor surface A preferably continues until the central unit 110 has found a certain predetermined first number of centre points P_1 which, including their immediate surrounding areas A''_1, are unique within

15 their part surfaces A'_1. When the predetermined first number of centre points P_1 has been found and registered, registering of the finger is considered complete.

An alternative way of carrying out the scanning is to scan the part surfaces

20 A'_1 in a given pattern, data on the centre points P_1 of all the part surfaces A'_1 being gathered and stored. When all the part surfaces A'_1 have been scanned, the central unit 110 selects a predetermined number of centre points P_1 which best meet certain criteria with regard to the requirement that the centre point P_1 is to be unique in its part surface A'_1.

25

A further alternative way of carrying out the scanning, which can save memory space, is to store the predetermined number of centre points P_1 in a table which is updated throughout the scanning process with the centre points which best meet the abovementioned criteria.

30

All the first number of stored centre points P_1 can of course be used for verifying a finger, but, in a particularly preferred embodiment of the invention, the central unit 110 selects a second number of the registered centre points P_1 with their respective immediate surrounding areas A''_1 for further use, the

35 centre points P_1 which are selected being those which best meet certain predetermined criteria. The exact sizes of the first and the second number of

centre points are of course dimensioning parameters which are determined by the desired speed and reliability of the registering method, but it has been found to be advantageous if the first number lies within the range 10-100 points, and the second number lies within the range 20-80% of the first
5   number. In a particularly preferred embodiment, 24 and, respectively, 16 points are used.

A method for verifying fingerprint information according to the invention will be described below. The type of verification for which the invention is
10   primarily intended is to check whether the fingerprint of a finger which is held against or over the sensing surface A of the sensor corresponds to a fingerprint whose information was registered previously.

For verifying a fingerprint according to the invention, the user therefore
15   places a finger against or over a part of the sensing surface A on the sensor 120. The central unit 110 initiates scanning of the sensing surface A of the sensor 120, which is carried out by a number of part surfaces A'_2 on the sensing surface A being scanned. In terms of size and position on the sensing surface A, the scanned part surfaces A'_2 preferably correspond to
20   the part surfaces used in the registering method described above, which means that each part surface A'_1 in the fingerprint data which is registered corresponds to a part surface A'_2 for verification. The part surfaces A'_2 which are analysed first in the verification method are those which correspond to the part surfaces A'_1 whose respective centre points P_1 are registered.

25

If, when a part surface A'_2 is scanned, it emerges that a point P_2 in the part surface A'_2, with its immediate surrounding area A''_2, has, on the basis of certain criteria, sufficient similarity to the centre point P_1 and its immediate surrounding area A''_1 in the corresponding registered part surface A'_1, the
30   point P_2 is approved provisionally, and its coordinates in relation to the part surface A'_2 are stored in the memory of the arrangement 100. The coordinate system used is suitably an orthogonal x-y system in each part surface A'_2 with the origin in the centre of the part surface. If more than one point P_2 in a part surface A'_2 meets said criteria, the point P_2 which best meets the criteria
35   is selected.

If a certain number of points P_2 have been approved and stored for the finger which is held against the sensing surface A, these points are selected for a first step in further processing.

5   In a possible verification method, the first step in the further processing quite simply comprises the fingerprint being considered verified, in other words the fingerprint which is held against or over the sensing surface A is considered to be identical with the fingerprint whose information is registered, if the number of approved points P_2 exceeds a certain predetermined number. If

10   greater reliability in verification is desired, however, the first step in the further processing can suitably also comprise the following, which is described with reference to Fig. 3.

The stored points P_2 are analysed as a group, and the mean value of the

15   coordinates (x_m, y_m) for all the points P_2 is calculated, analysis and calculation suitably being carried out in the central unit 110. The calculation therefore provides a coordinate pair (x_m, y_m) which can be seen as a point in each part surface A'_2. The points P_2 in the group are then arranged in a list, starting from the absolute value of the distance d between the coordinates (x_2, y_2) of a

20   point and the calculated mean value point (x_m, y_m). The distance d in a part surface A'_2 is illustrated diagrammatically in Fig. 3.

A certain number of the points highest on the list are then selected for a second step in further processing. If appropriate, this second step can quite

25   simply comprise the fingerprint being considered verified, in other words the fingerprint which is held against or over the sensing surface A is considered to be identical with the fingerprint whose information is stored, if a sufficient number of points have an absolute value d below a certain value. If greater reliability in verification is desired, however, the second step in the further

30   processing can suitably comprise the following:

The mean value of the coordinates (x_2, y_2) of the selected points is calculated, and the absolute value of the distance between this mean value point and the coordinates (x_2, y_2) of each selected point is analysed. If a certain number of

35   points P_2 have a distance to the mean value point with an absolute value which is below a certain limit value, the fingerprint is considered verified, in

other words the fingerprint which is held against or over the sensing surface A is considered to be identical with the fingerprint whose information is registered.

5 The numbers of points required in the various steps of the verification method are of course, in the same way as with the numbers in the registering method, dimensioning parameters which are selected on the basis of the combination of speed and reliability desired in the arrangement. By way of example, however, it may be mentioned that the number of points selected

10 for a first step in further processing during verification can suitably correspond to the number of points selected in the final step of registering, in the present case, in other words, 16 points. The number of points selected for a second step in further processing in verification suitably lies within the range 20-60% of the number of points selected for the first step, preferably

15 50%, in the present case, therefore, 8 points.

The verification method described above means that good results are obtained even if, during a verification procedure, a user holds his finger displaced at right angles in the lateral or longitudinal direction in relation to

20 the position the finger was in at the time of registering. As the user may also, at the time of verification, hold his finger in a rotated position in relation to the position the finger was in at the time of registering, the invention comprises means and a method to make it possible to carry out verification with good results even in such cases. This will be described below with reference to

25 Fig. 4.

In order that the verification will be insensitive to rotation of the finger, scanning and comparison are carried out according to the above description, in other words part surfaces A'_2 on the sensing surface are scanned. These

30 part surfaces A'_2 are compared with corresponding part surfaces A'_1 in the registered fingerprint with regard to centre points and the immediate surrounding areas of the centre points. In order to achieve rotation-insensitivity, however, each part surface A'_2 is displaced into a number of different angular positions α around an imaginary vertical line L on the

35 sensing surface A before it is compared with the corresponding part surface A'_1. Comparison is then carried out with the part surfaces A'_2 in each of these

angular positions. If, in one and the same angular position, said number of points P_2 have sufficient similarity, on the basis of the abovementioned criteria, to their corresponding registered part surfaces A'_1, these centre points P_2 are selected for a first step in further processing, according to the description above.

In the same way as described above, the scanning over the sensing surface A of the sensor 120 is controlled by the central unit 110 of the arrangement 100 in the rotation-insensitive case also. The different angular positions α are achieved by information about the finger which is held against the sensing surface A being stored in the memory 110 of the arrangement in the angular position in which the user holds the finger, after which rotation of the stored information takes place before comparison is carried out.

The number of angular positions into which the part surfaces A'_2 are displaced can in principle be arbitrary, but the number of angular positions preferably lies within the range 10-100, and 16 angular positions can advantageously be used. The locations of the angular positions can in principle be selected freely, but, in a preferred embodiment, an odd number of angles α is selected around an imaginary centre line L on the sensing surface A, with one angular position which corresponds to $\alpha=0$, and an even number of angular positions of the same magnitude on each side of the centre line.

The invention is not limited to the embodiments described above but can be varied freely within the scope of the patent claims below.

CLAIMS

1.   Method for registering fingerprint information via a sensing surface A, against or over at least a part of which sensing surface A a finger can be held, c h a r a c t e r i z e d i n that the method comprises:
-        scanning part surfaces A'_1 in the sensing surface A,
-        checking whether the centre point P_1, with its immediate surrounding area A''_1, of each part surface A'_1 scanned is unique within the part surface A'_1,
-        a first number of centre points P_1 which, with their respective immediate surrounding areas A''_1, are unique in their respective part surfaces A'_1 being registered, the respective immediate surrounding areas A''_1 of the points and the respective part surfaces A'_1 of the points also being registered.

2.   Method according to claim 1, according to which a certain second number of the registered centre points P_1, with their immediate surrounding areas A''_1, are selected for further use.

3.   Method for verifying fingerprint information via a sensing surface A, against or over at least a part of which sensing surface A a finger can be held, in which verification is carried out on the basis of previously registered information relating to at least one fingerprint which is to be approved in the verification method, which information has preferably been registered according to the method in claim 1, c h a r a c t e r i z e d i n that the method comprises the following:
-        a number of part surfaces A'_1 with their respective centre points P_1 in the fingerprint whose information is registered are compared with corresponding part surfaces A'_2 on the sensing surface A,
-        if there is a point P_2 on a part surface A'_2 on the sensing surface which, with its immediate surrounding area A''_2, corresponds, on the basis of certain criteria, to the registered centre point P_1, including the immediate surrounding area A''_1 of the stored centre point in the corresponding stored part surface A'_1, the point P_2 with its part surface A'_2 is approved,

- if a certain number of points P_2 with associated part surfaces A'_2 have been approved, these are selected for a first step in a further processing.

5   4.   Method according to claim 3, also comprising information about the part surfaces A'_2, for comparison with the part surfaces A'_1, being displaced into a predetermined number of angular positions, comparison being carried out with the part surfaces A'_2 in each of said angular positions, and, if said number of points P_2 of part surfaces A'_2 satisfy said conditions in
10   one and the same angular position, these points P_2 being selected for the first step in the further processing.

   5.   Method for verifying fingerprints according to claim 3 or 4, according to which the first step in the further processing of the selected
15   points P_2 with their respective part surfaces A_2 comprises a number of the selected points P_2 and the part surfaces A_2 being analysed as a group as follows:
- the mean value of the coordinates (x,y) for the points P_2 in their respective part surfaces A_2 is calculated,
20   - the mean value calculated is seen as a point in each part surface A_2,
- a certain number of the points P_2 with their associated part surfaces A_2 are selected for a second step in a further processing, the points P_2 which are selected being those points in the group which have the smallest distance to the mean value point in their respective part
25   surface A_2.

   6.   Method for verifying fingerprints according to claim 5, according to which the second step in the further processing of selected points P_2 with respective part surfaces A_2 comprises a number of the selected points P_2 and
30   the part surfaces A_2 being analysed as a group as follows:
- the mean value of the coordinates (x,y) for the points P_2 in the part surfaces A_2 is calculated,
- the mean value calculated is seen as a point in each part surface A_2,
- the distance between the points P_2 in the group and the mean value
35   point is analysed,

- if the distance between a certain number of points P_2 and the mean value point is below a certain limit value, the fingerprint is considered verified.

5   7.   Arrangement (100) for use for registering fingerprint information, comprising a central unit (110), a sensor (120) with a sensing surface A, against or over at least a part of which sensing surface A a finger can be held, and a power supply unit (130), c h a r a c t e r i z e d   i n   that it comprises:

10 -   means (110, 130) for scanning part surfaces A'_1 in the sensing surface A of the sensor (120),

    -        means (110, 130) for analysing whether the centre point P_1, with its immediate surrounding area A''_1, of a scanned part surface A'_1 is unique within the part surface A'_1,

15 -   means (110, 130) for registering a first number of centre points P_1 which, with their respective immediate surrounding areas A''_1, are unique in their respective part surfaces A'_1,

    -        means (110, 130) for registering the part surfaces A'_1 whose centre points P_1 are registered.

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    8.   Arrangement (100) according to claim 6, also comprising means (110) for selecting a certain second number of the registered part surfaces A'_1 with associated centre points P_1 and immediate surrounding areas A''_1 for further use.

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    9.   Arrangement (100) for use for verifying fingerprints on the basis of previously registered information relating to at least one fingerprint which is to be approved by means of the arrangement, which arrangement comprises a central unit (110), a sensor (120) with a sensing surface A, against or over

30 at least a part of which sensing surface A a finger can be held, and a power supply unit (130), c h a r a c t e r i z e d   i n   that it comprises the following:

    -        means (110, 130) for comparing a number of part surfaces A'_1 with respective centre points P_1 in the fingerprint whose information is registered with corresponding part surfaces A'_2 on the sensing surface

35   A,

- means (110) for selecting and approving a number of points P_2 with corresponding part surfaces A'_2 on the sensing surface A, which points P_2, with their immediate surrounding areas A''_2, correspond, on the basis of certain criteria, to the stored centre point P_1, including the immediate surrounding area A''_1 of the stored centre point in the corresponding stored part surface A'_1,

- means (110) for processing the approved points in a first step in further processing.

10. Arrangement according to claim 9, also comprising means (110, 130) for displacing information about the part surfaces A'_2, for comparison with the part surfaces A'_1, into a predetermined number of angular positions, the means for comparison (110, 130) carrying out comparison in each of said angular positions, and the means (110) for selecting and approving a number of points, for the first step in the further processing, approving said number of points P_2 of part surfaces A'_2, if these points satisfy said conditions in one and the same angular position.

11. Arrangement (100) according to claim 9 or 10, also comprising the following means for carrying out said first step in the further processing:

- means (110) for analysing a group of the approved points P_2 and the part surfaces A_2,

- means (110) for calculating a mean value point for the coordinates (x,y) of the points P_2 in the part surfaces A_2 in the group,

- means (110) for selecting a certain number of the points P_2 with their associated part surfaces A_2 for a second step in further processing, the points P_2 which are selected being those points which have the smallest distance to the mean value point in their respective part surface A_2.

12. Arrangement (100) according to claim 11, also comprising the following means for carrying out said second step in the further processing:

- means (110) for analysing a group of the points P_2 and the part surfaces A_2 selected for a second step,

- means (110) for calculating a mean value point for the coordinates (x,y) of the points P_2 in the part surfaces A_2 in the group,

    -    means (110) for calculating the distances between the points P_2 in the group and the mean value point,

    -    means (110) for analysing whether the distance between a certain number of points P_2 and the mean value point is below a certain limit value, in which case the fingerprint is considered verified.

ABSTRACT

The invention relates to a method for registering fingerprint information via a
sensing surface A. The method comprises scanning part surfaces A'_1 in the
5   sensing surface A, checking whether the centre point P_1, with its immediate
surrounding area A''_1, of each scanned part surface A'_1 is unique within the
part surface A'_1, and registering a first number of centre points P_1 which, with
their respective immediate surrounding areas A''_1, are unique within their
respective part surfaces A'_1. The respective immediate surrounding areas
10   A''_1 of the points and the respective part surfaces A'_1 of the points are also
registered.

The invention also relates to a method for verifying fingerprint information, in
which verification is carried out on the basis of registered information relating
15   to a fingerprint which is to be approved in the verification method. The
method comprises a number of part surfaces A'_1 with their respective centre
points P_1 in the fingerprint whose information is registered being compared
with corresponding part surfaces A'_2 on the sensing surface A. If there is a
point P_2 on a part surface A'_2 on the sensing surface A which, with its
20   immediate surrounding area A''_2, corresponds to the registered centre point
P_1, including its immediate surrounding area A''_1 in the corresponding stored
part surface A'_1, the point P_2 with its part surface A'_2 is approved. If a certain
number of points P_2 with associated part surfaces A'_2 have been approved,
these are selected for a first step in further processing.
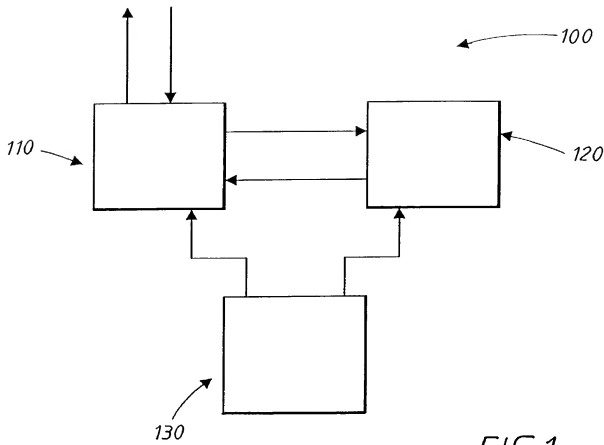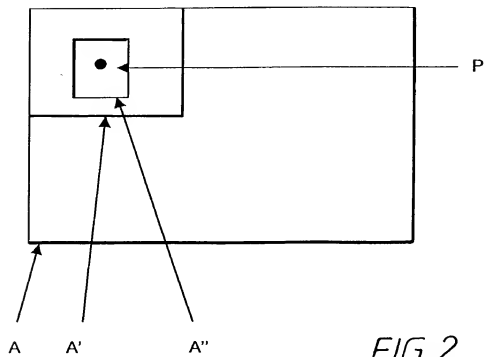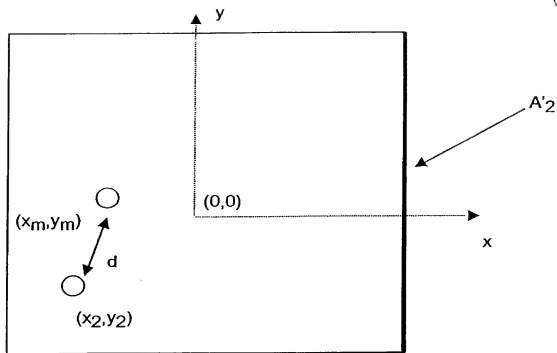
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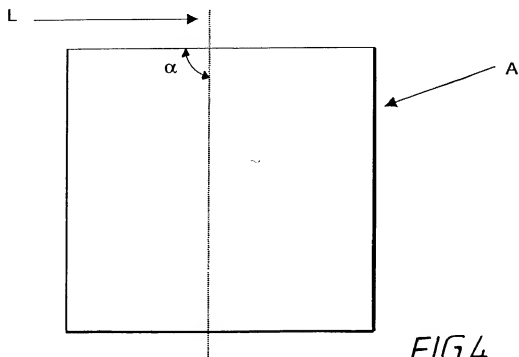(Fig. 2)

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FIG.1

FIG.2

2/2

FIG. 3

FIG. 4

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FOR **PATENT** AND **DESIGN** APPLICATIONS

ATTORNEY DOCKET NO.
1807-0159P

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated next to my name; that I verily believe that I am the original, first and sole inventor (if only one inventor is named below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Insert Title: ➡ <u>Method and arrangement for registering and verifying fingerprint information.</u>

Fill in Appropriate Information -
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Specification
Attached:

the specification of which is attached hereto. If not attached hereto,

the specification was filed on _____ as

United States Application Number _____; and /or

the specification was filed on <u>24 August 2000</u>_____ as PCT

International Application Number <u>PCT/SE00/01623</u>____; and was

amended under PCT Article 19 on _____ _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I do not know and do not believe the same was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (six months for designs) prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as follows.

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Information: ➡
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Prior Foreign Application(s)

			Priority Claimed	
<u>9902990-2</u>	<u>Sweden</u>	<u>August 24 1999</u>	☒	☐
(Number)	(Country)	(Month/Day/Year Filed)	Yes	No
			☐	☐
(Number)	(Country)	(Month/Day/Year Filed)	Yes	No
			☐	☐
(Number)	(Country)	(Month/Day/Year Filed)	Yes	No
			☐	☐
(Number)	(Country)	(Month/Day/Year Filed)	Yes	No
			☐	☐
(Number)	(Country)	(Month/Day/Year Filed)	Yes	No

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below.

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Insert Prior U.S.
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(if any)

(Application Number)	(Filing Date)	(Status - patented, pending, abandoned)
(Application Number)	(Filing Date)	(Status - patented, pending, abandoned)

I hereby appoint the following attorneys to prosecute this application and/or an international application based on this application and to transact all business in the Patent and Trademark Office connected therewith and in connection with the resulting patent based on instructions received from the entity who first sent the application papers to the attorneys identified below, unless the inventor(s) or assignee provides said attorneys with a written notice to the contrary:

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15 —

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